AUGUST, 1916 EXTENSION CIRCULAR, No. 19

N. C. College of Agriculture and Mechanic Arts
N. C. State Department of Agriculture
N. C. Agricultural Experiment Station
Raleigh and West Raleigh

Agricultural Extension Service

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The Southern Corn Bill Bug

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INTRODUCTION.

The corn bill bug is one of the most important insect enemies of corn in the eastern part of the State. Its present known range is shown in the accompanying map. (Fig. 1.) The doubly shaded portion in this

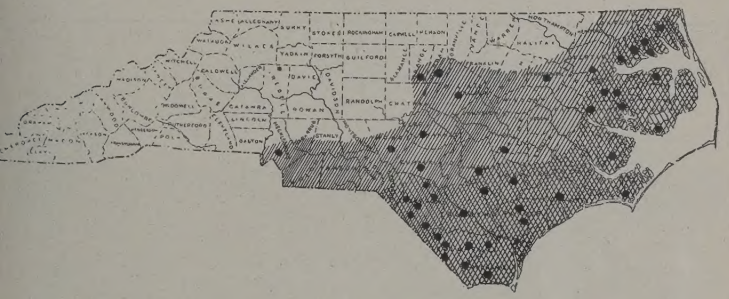

Figure 1. Map of North Carolina to show the distribution of the Southern Corn Bill Bug in the State. Shaded portion approximate distribution in the State. Doubly shaded portion area of greatest destruction. Dots represent localities in which the Southern Corn Bill Bug has been observed. (Original.)

map represents the area of the State in which this insect has done the most damage. The shaded portion represents the approximate distribution of the insect in the State. The places where the insect has actually been observed are represented by dots. This insect is apt to prove troublesome in any part of its range on low swampy soil, especially in land that has been infested with nut grass, chufas or similar grasses.

The present circular is intended to give a brief outline of the life of this insect, together with remedies that may be used for its control. The discussion of the life history of the pest has been made as brief as possible in order to cover the essential points that are necessary to a knowledge of the best methods of control. The methods of control have been given as completely as possible in order that the farmer may be able to understand just what remedies are best suited to his conditions.

COMMON NAMES.

The Southern corn bill bug has a large number of names in this State, the most common being derivatives of the name "Curlew Bug." This name is given on account of its fancied resemblance to the Curlew, which was a fairly common bird on our coast. The long curved bill resembles to a certain extent the snout of the corn bill bug. Some of the more common corruptions of the name "Curlew Bug" are "Klew" or "Clew Bug" and "Curlie Bug." It is also generally known as "bill bug" and "corn bill bug." The rice growers speak of it familiarly as "Rice Bug" and "Rice Bill Bug." In other sections it is known almost exclusively as "Chufa Bug" from its habit of feeding to a great extent

Figure 2. Portion of a corn field to show injury by the Southern Corn Bill Bug. Notice the large numbers of stalks missing and great variation in size of corn planted at the same time. (Original.)

upon the chufa. Other names may be used in various localities, but in the writer's experience these names are the ones most commonly used.

In this circular the writer has adopted the name Southern Corn Bill Bug to distinguish it from other corn bill bugs found in other parts of the country. The writer feels that the selection of this name needs no special defense. He has selected it in place of the more common "Curlew Bug" for the reason that it calls to one's attention at once that this is the bill bug that is especially destructive to corn in the Southern States which the name Curlew Bug does not suggest.

DESTRUCTIVENESS.

The corn bill bug is one of the most destructive insect enemies of corn. Many insects are more or less troublesome to corn, but the writer knows

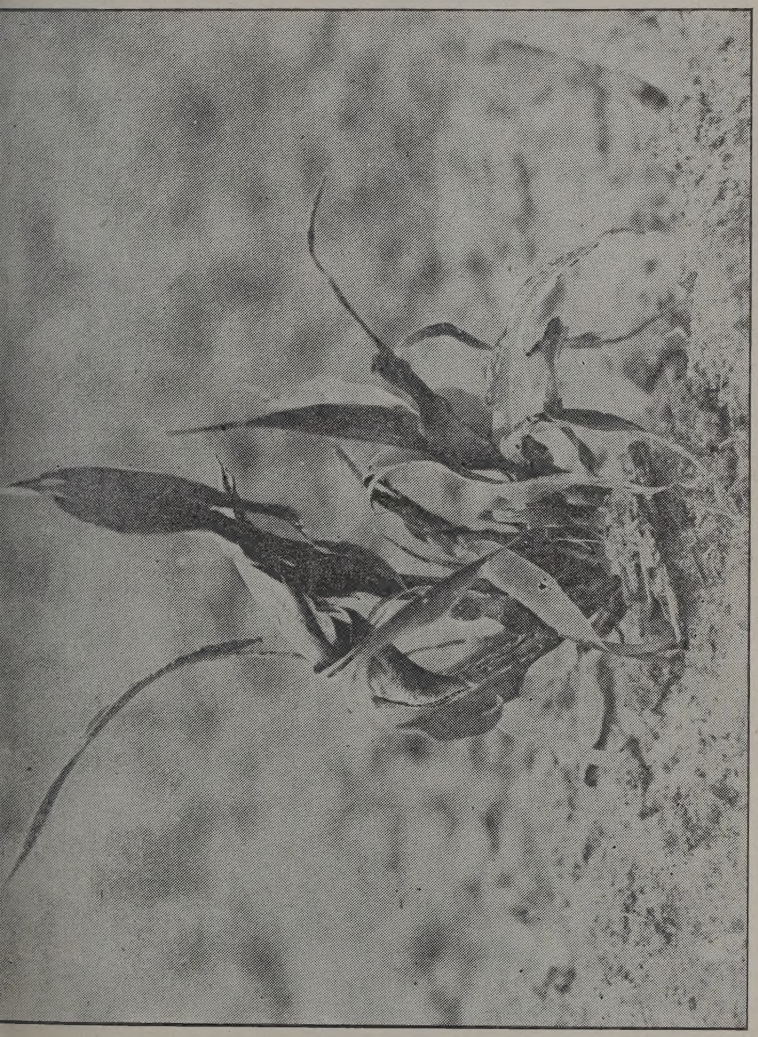

Figure 3. Stalk of young corn showing injury by the larva (grub) of the Southern Corn Bill Bug. (Original.)

of few insects that so completely destroy the corn in a field. Figure 2 gives a general view of a field in which the corn bill bug has been at work. Only a very few stalks are left standing, and these are not apt

to survive very long. It is not unusual for the farmer to replant his corn four or five times and then not get a stand. In fields planted at

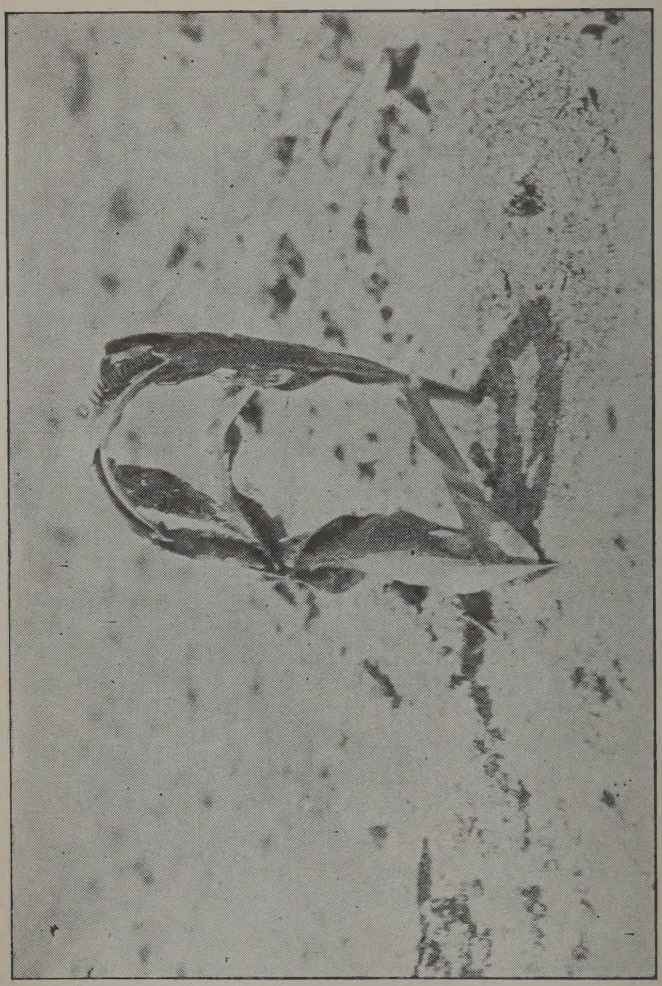

Figure 4. Stalk of old corn showing injury by the larva (grub) of the Southern Corn Bill Bug. (Original.)

the usual time most of the corn is killed by the adults before it has a chance to start. This is especially true if the spring is cold and damp, which is the most favorable time for the bill bugs to work. The few

stalks that escape being destroyed by the adults are usually attacked by the larva or grubs which eat away the lower part of the stem and tap root, causing the plant to die or to be so badly stunted that it does not make further growth. (Figures 3 and 4.)

HOW THE WORK OF THIS INSECT MAY BE RECOGNIZED.

The work of this insect is often confused with the work of several other insects which are troublesome in corn. It is necessary to recognize the work of this insect clearly in order to be sure that the proper remedy is being applied. In the spring when the corn is coming up it is

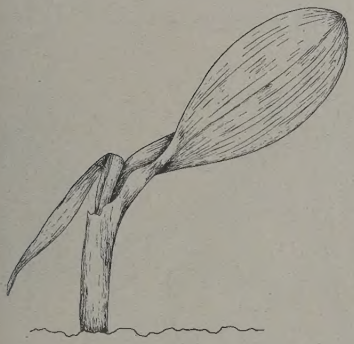

Figure 5

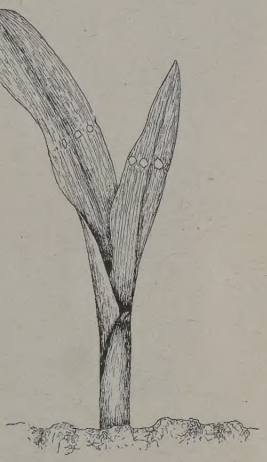

Figure 6

Figure 5. Stalk of corn showing injury by the Southern Corn Root Worm. Note that the bud or unfolding leaves are dying. (Original.)
Figure 6. Stalk of corn showing injury by the adult of the Southern Corn Bill Bug. Note the rows of regular holes across the leaves. (Original.)

quite commonly attacked by two insects which kill it before it has a chance to make much growth.

One of these insects is the Southern Corn Root Worm, often called bud worm, or drill worm, because it "drills" a small round hole into the stalk of corn below ground and causes the "bud" to die. This work may be recognized at this early period of growth because the "bud" or unfolded leaves wither and droop while the "seed leaf" stands up. A little later the "bud leaves" turn yellow and then brown while the "seed leaf" remains green for several days. (Figure 5.) The seed leaf eventually dies, and unless the farmer is in the field at the time the corn is sprouting or shortly after, he is apt to conclude that his poor stand is due to the fact that his seed failed to germinate.

Plants that are attacked by the corn bill bug early in the season show rows of round holes across the leaves. (Figure 6.) This is due to the fact that the bill bug eats into the stalk near the level of the ground

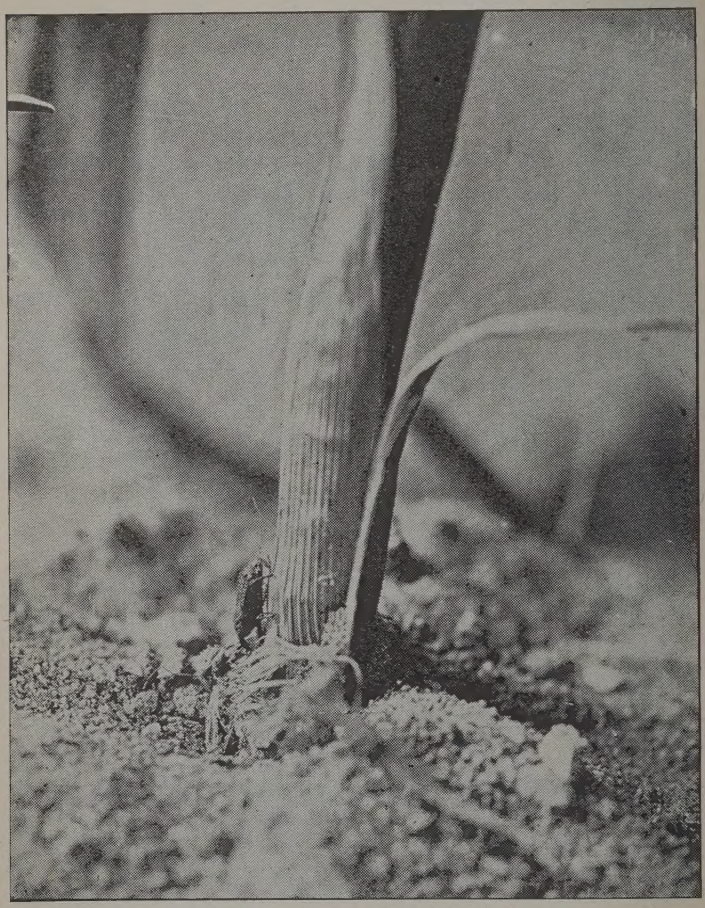

Figure 7. Adult Southern Corn Bill Bug feeding on corn. (Original.)

where the leaves are rolled up, thus by simply eating into the stalk at one place he cuts a row of holes across the leaf. When young plants are thus attacked they are so badly stunted that they make no growth and

eventually they die. These plants are usually killed off at about the same time as the plants which are killed by the root worm, so that unless the farmer is in the field at the proper time he is apt to think that his poor stand is due to poor seed or damp weather or to any other cause except the right one.

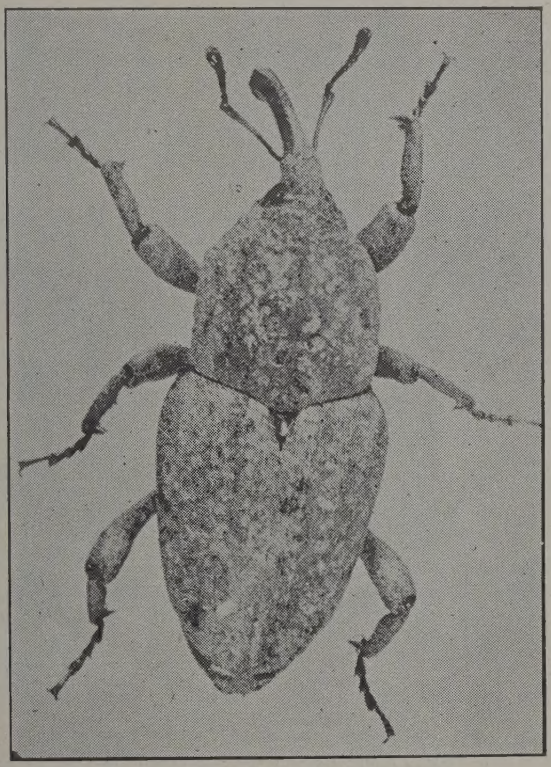

Figure 8. Adult Southern Corn Bill Bug. Much enlarged. (After Smith.)

If the plant escapes this first attack it is attacked again and again, and as the leaves unfold they show the characteristic rows of holes across the leaf. Several other insects, especially the stalk borer and the ear worm work higher up in the bud or unfolding leaves and also eat rows of holes across the leaf, but in our experience these rows of holes are never as regular as the rows of holes eaten by the bill bug which works down near the surface of the ground.

The farmer should attempt to get as familiar with the work of these various insects as possible, because the remedies which may be used

against one are not always effective against the other. One of the best ways to recognize the work of the corn bill bug is to find the insect actually at work on the base of the stalk sometimes nearly buried beneath the ground. (Figure 7.) So far as we are aware this is the only insect with a beak about half as long as his body that feeds on the corn stalk near the ground.

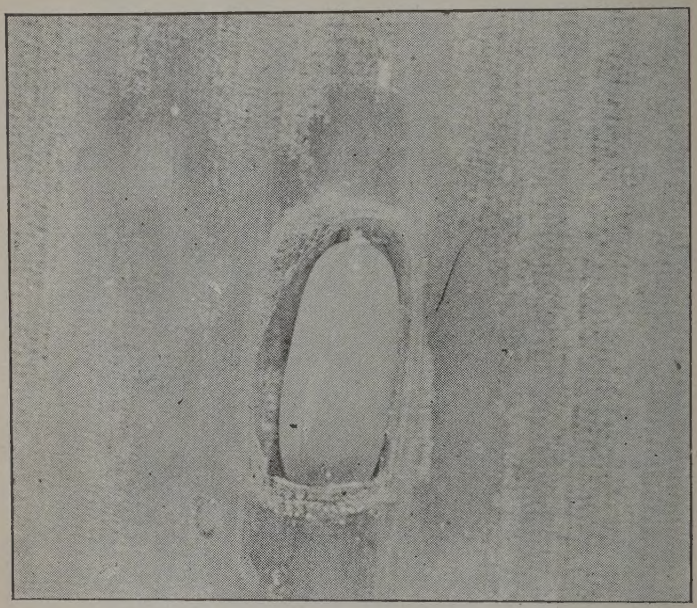

Figure 9. Egg of Southern Corn Bill Bug in little pocket in corn leaf. Much enlarged. (Original.)

LIFE HISTORY AND DESCRIPTION OF THE STAGES.

A thorough knowledge of the life history and habits of an insect are necessary to an understanding and to a proper application of methods of control. The following observations are based on four years study of this insect both in the field and in the laboratory. These observations have been condensed as much as possible and still leave them complete enough so that they may be understood.

The corn bill bug in common with many other kinds of insects has four stages in its life history: (1) The adult, (2) the egg, (3) the larva (grub or maggot), (4) the pupa (chrysalis or cocoon). Often these stages are so different that there seems to be no connection between the

one and the other. In most cases, among the group of beetles to which the Southern corn bill bug belongs, both the grub and the adult are injurious to the plants on which they feed.

Figure 10. Larva (grub) of Southern Corn Bill Bug in tap of corn, showing tunnel. (Original.)

The adult corn bill bug (Figure 8) is a blackish or brownish hard-shell bug or beetle a little less than ½ inch long with a long snout or beak about half as long as his body. At the end of this snout

Figure 11. Pupa of Southern Corn Bill Bug in tap root of corn stalk. (Original.)

are sharp jaws which make it possible for this bug to eat a hole down into the stalk and then eat out the tender growing bud, thus the insect is able to injure the plant very seriously. These adults go into the ground late in the fall where they stay all winter, coming out the following spring, usually in April, when they commence to feed on the corn. They seem to increase very greatly in numbers day by day until the last of May, by which time most of the adults seem to have come out of their winter quarters. Usually by the first of May the adults commence to lay eggs (Figure 9). These eggs are usually placed in cavities which the females have eaten into the stalk of corn, and they are usually on a level with or slightly below the level of the ground. (Figure 7.) In young corn the eggs are usually laid deep in the heart of the plant, but in the older corn they are simply laid in little pockets in the inner sides of the thick outer leaves of the corn plant. (Figure 9.) Sometimes the adult lays the egg loosely among the roots and the grubs (larva) which hatch from these eggs, feed on the corn roots, causing very severe injury in this way.

The corn bill bug commences to lay eggs in early May and continues more or less regularly through the summer. They are still laying eggs in late corn in late September, but they undoubtedly are not as prolific after this date. In a little less than a week after the eggs are laid they hatch into white footless grubs with brownish heads. (Figure 10.) These grubs eat their way downward and toward the center of the stalk, devouring most of it as they proceed. In this way they work towards the tap root (Figure 10), which is sometimes almost completely destroyed.

The grubs are very destructive to corn, perhaps more so than the adults, although the adults are usually held responsible for all of the work of destruction that goes on in the field because they are plainly visible on the outside of the corn stalks, while the grubs are hidden away on the inside of the stalk where they will escape notice unless they are especially searched for. The stalks that escape being destroyed by the adults are usually finished by the grubs.

After the grubs have fed from four to six weeks they change to the pupa (Figure 11), which is yellowish-white in color and a little less than one-half inch long. This stage shows all of the characteristics of the adult, the beak, wings and legs being closely wrapped around the body. The pupa is usually formed in the burrow made by the larva, the burrow being simply packed with chewed up fragments of corn. In this cell the pupa lies for a week or ten days and the adults emerge.

The earliest adults to emerge join the old adults in the field and feed with them until they go into winter quarters. The later adults to emerge from the pupa in the fall seem to remain over winter in the pupal cells, not coming out till the following spring.

Thus this insect seems to have but a single generation each year, but each female lays from 200 to 400 eggs, so that the numbers increase very rapidly, especially as this pest has no important enemies.

The adults seem to be most active in the field in the morning from six to about nine, and again in the evening from five to about eight. During the day they seek shelter under sticks, stones and clods in the corn field. At these times the adults are often very common, sometimes being found at the rate of more than 1800 per acre. This would be an average of about one adult for each five stalks of corn, figuring on the basis of four foot rows with the stalks one foot apart in the rows, which readily accounts for the rapidity with which bill bugs destroy a field of corn.

CONTROL.

The control of the corn bill bug is not an especially easy farm practice. This is due to a number of different factors. In the first place the insect cannot be attacked by any direct remedies, both because of its hardiness and because most of its life is spent in the stalk of corn or buried beneath the ground. The only direct method that might be used to any avail against this insect is hand picking of the adults in the early spring and destroying them by throwing them into boiling water or kerosene. This practice would be too expensive to use on general crop corn, but might be used in small fields of corn which were being grown for roasting ear purposes. If this method were to be used it would be advisable to scatter chips about the field under which the bugs would crawl during the middle of the day and from which they could be collected readily.

In the main the farmer in the bill bug section of the State will have to depend upon a slight modification of his usual farm practice to control the corn bill bug.

Careful observations made during the past several seasons show quite clearly that the control is not a very easy matter. It has also been clearly demonstrated that no one method can be used with any great success against this insect, but rather that the control is dependent upon a number of factors which taken together give us a system of corn farming somewhat different from the systems practiced in the corn bill bug section at the present time. These factors are discussed separately in some detail below, but it must be emphasized again that the farmer cannot put his dependence in any one method alone, but instead that he must work out a system of corn farming with these various factors in mind. In this connection it must also be emphasized here that a system which is built upon a basis of the factors here given is not necessarily a good system for growing corn in all sections of the State under all conditions, but rather that this is the system the farmer should employ in the corn bill bug sections of the State if he hopes to grow corn with the minimum of loss by corn bill bugs. Neither is it intended to imply that this system will avoid the attacks of other insect enemies of corn, but is simply to be used where the corn bill bug is the most important insect enemy of corn. The writer believes that the farmer who follows this system will also be doing the most important things in the control

of many of the more important insect enemies of corn, but there are so many factors involved both in the many varieties of insect pests and climatic and other conditions which have not been studied in detail that it would not be surprising if certain insects were not controlled by following the suggestions as outlined here.

The writer believes that the following factors are the most important factors involved in any system for the control of the corn bill bug, both from the standpoint of ease and cheapness of application: (1) Time of planting, (2) rotation of crops, (3) fertilization, (4) drainage, (5) ridging, (6) fall and winter plowing, (7) thorough cultivation, (8) destruction of native food plants. It will be noted at once that all of these factors are what might be called indirect methods of control. From the very nature of the case it would be impossible to apply any direct methods, for all such methods are expensive and the returns from corn are never great enough to justify the expense involved in their application.

TIME OF PLANTING.

A series of experiments carried on during 1912 proved very conclusively that time of planting is an important factor in the control of the corn bill bug. Plots of corn were planted on the following dates: March 23, April 13, May 3, June 3, July 3. Careful inspections were made of these plots from time to time, and the following rough percentages will give an indication of the amount of injury:

Date Corn was Planted.	Percentage Injured.
March 23	6
April 13	37
May 3	74
June 3	85
July 3	94

From these figures it seems safe to conclude that in order to grow corn successfully in the corn bill bug section of the State it is necessary to plant the corn before the middle of April. However, too much dependence must not be placed in this one factor. For if all the other elements that go to make up the successful method of control of this insect are neglected, early planting alone will not insure a successful crop.

The reason that early planting is successful against this insect is undoubtedly because the early corn gets a start and is thus able to keep ahead of the attacks of the bugs. In the fields it always seems that when corn gets to be about waist high that it is no longer much troubled by corn bill bugs, but that it is able to continue growing in spite of their attacks. Corn planted in late March in the eastern part of the State in the usual season has made such a satisfactory growth before the bill bugs come out of winter quarters that it continues to grow right along

in spite of their attacks. On the other hand corn planted after mid-April is just coming up at the time of the greatest prevalence and greatest activity of the adults. Fields planted at such times are so badly damaged that they cannot produce a satisfactory crop.

ROTATION OF CROPS.

Rotation of crops is an important factor in the control of the corn bill bug just as it is in the control of other important insect enemies of farm crops. This is due apparently to two reasons: (1) to the fact that if crops are moved from field to field the insects are forced to move also because as a general thing insects which feed on corn do not feed upon other farm crops. In forcing the insects to move in this way, the chances are that they will not be able to find the new location, and as a result will die for the want of feed. (2) When corn is grown continuously on a field for a number of years the food which the corn requires becomes so exhausted that the corn does not make a satisfactory growth, and hence it readily succumbs to the attacks of insects. Whereas, if proper crop rotation has been practiced, the corn would get a satisfactory start and would be strong and vigorous enough to withstand the attacks of insects to a certain extent at least.

FERTILIZATION.

Fertilization is perhaps next to "time of planting" the most important factor in the control of this insect. This is not of course the proper place to enter into a discussion of the proper fertilizer to use for corn, but it has been shown on one of our experimental plots that an application of fertilizer will make the plants grow much more rapidly, and hence be less liable to be fatally injured by the corn bill bug than plants which have not been heavily fertilized. (Figure 12.) In the same way a heavy application of lime to land that is sour will make the plants grow much more rapidly and thus escape the attacks of the bill bug. The importance of lime may be further emphasized by the fact that very much of our corn land in the corn bill bug sections of the State is naturally very acid.

The belief so prevalent in the corn bill bug sections that fertilizers act as repellants against the corn bill bug does not seem to be based on facts. Repeated experiments with various mixtures of fertilizers, air-slaked lime, tobacco dust, tobacco extract and basic slag failed to show that the adult beetle was deterred from feeding and laying eggs in plants thus protected. In some cases the material used as a repellant was actually mounded around the base of separate corn stalks, yet the beetles crawled over the mounds of the supposed repellant to feed upon the protected stalk. In all cases where a repellant action has been ascribed to any fertilizer, the writer is of the opinion that the results observed are not due to the repellant action of the fertilizer, but to the fact that such plants are growing rapidly owing to an excess of food material, hence they escape the attacks of this insect.

DRAINAGE.

It is a matter of common observation that the corn bill bug is worse in low wet lands than it is in uplands. Naturally this has led to the statement that the most important factor in the control of the corn bill bug is proper drainage of the land, and while this is an important remedy, its importance might easily be over-emphasized. The Pender Test Farm is exceptionally well tile drained, yet the bill bug has not become a negligible factor on this farm. And while we must not leave

Figure 12. Experimental plot to show the effects of fertilizer. Row in center and row on extreme right of picture heavily fertilized. The three rows between with the usual amount of fertilizer. (Original.)

the impression that proper drainage is not an important factor in the control of this insect, yet we must caution the farmer against assuming that drainage is all important. It would not be possible for the corn bill bug to be worse than we have observed it on some well drained fields. (Figure 2.)

RIDGING.

Observations made in fields in various parts of the bill bug sections of this State show that stalks of corn which are on a slight elevation above their neighbors nearly always escape the attacks of the corn bill bugs for a longer period. Sometimes stalks which are on very slight elevations will not be attacked while all the rest of the corn in the field has been very severely injured. The amount of immunity to attack

seems to be out of all proportion to the height of the ridge. This was especially noticeable in a field on the Perdue Test Farm where many

Figure 13. Experimental plot to show the effect of planting corn on a slight ridge. Row on extreme left, row in center and row on extreme right planted on a ridge about eight inches high. Rows between planted on the level. (Original.)

stumps had been recently pulled. In pulling the stumps a ridge of earth was left around a hole which was usually quite shallow after the plow had passed over it. Corn on this ridge either was stunted from

attack or was attacked only after all the other stalks in the vicinity had been seriously injured or killed. This led to the belief that if corn was planted on a ridge it would to a certain extent escape from the attacks of the insect.

This method was tried, and three rows through one of the plots (Figure 13) were planted on a ridge which averaged about eight inches high. Corn was planted on these ridges and in rows between the ridges on June 20th. Careful examination made a month later showed that 45 per cent of the corn on the ridges had been injured, whereas 98 per cent of the corn in the rows between the ridges had been injured. Another examination showed that the corn on the ridges had been able to continue its growth and was much more advanced than the corn on the level.

This method is not generally applicable, owing to the cost of constructing ridges. It is mentioned in this connection because it might be used for the growing of early corn for market purposes where the expense involved would not be such an important item. This method must not be confused with the general practice of ridging corn at the time of the last cultivation. In the ridging method as here outlined the corn is planted upon a ridge. This method would be applicable only to lands that are very moist and where bill bugs normally abound and not to lands that are very dry.

FALL AND WINTER PLOWING.

Fall and winter plowings have been tried to a limited extent upon small plots, but no very striking difference could be noted in favor of this practice. However, if most of the adults live over the winter in the fields, the plowing of the land in the late fall or in the winter would disturb them very seriously and would act as a decided check upon their ravages. If on the other hand, only a small number of beetles live over winter in the corn fields, then the fall or winter plowing would not be such an important factor in the control of the bill bugs. The writer believes, however, that even if it should be proven that only a fraction of the adults hibernate in the corn fields, the practice of fall or winter plowing would be profitable as a factor in the control of the corn bill bug where the same field was to be planted to corn two years in succession.

THOROUGH CULTIVATION.

It has been stated that frequent shallow cultivation will keep the corn bill bug in control. And there are many things that would lead one to believe that this might be true. As discussed above, the adults spend considerable time hiding away under clods, etc. Therefore, it would seem but logical that cultivation would have a tendency to break up these retreats, and if the cultivations were frequently made that

they would have a tendency to keep the insects disturbed, and these factors perhaps have some importance. However, a rather long series of observations has led the writer to believe that the effects of cultivation are not upon the bill bugs directly, but are rather upon the corn, causing it to grow more rapidly, and hence to be much more resistant to the attacks of all its pests. Observations show that corn that is well cultivated will generally make a better growth when attacked by corn bill bugs than corn which is improperly cultivated, but on the other hand the writer has frequently seen corn succumb to the attacks of this insect when so far as he could determine, the corn had had the very best of cultural attention. Then again, counts of the number of bill bugs per acre made in widely varying localities and ranging from fields in a high state of cultivation through innumerable graduations to fields that had just been cleared and never plowed, but in which the corn had been "stuck," failed to show any constant correlation between the state of cultivation and the number of bill bugs present per acre. During 1915 the corn in the experimental plots on the Pender Test Farm was given very poor cultivation and was badly damaged by corn bill bugs, but the adjacent plots which were devoted to other experiments were given very careful cultivation. Yet so far as could be determined both plots were about equally injured. At least, the plots devoted to the other experiments had to be replanted, owing to the great amount of injury by corn bill bugs.

However, the writer does not mean to imply by any of the above statements that corn could be grown as well without cultivation as with proper cultivation. Nothing could be farther from the truth. Yet it does seem worth while to correct a growing misconception to the effect that proper cultivation is an entirely effective method of control for the corn bill bug.

DESTRUCTION OF NATIVE FOOD PLANTS.

The corn bill bug is undoubtedly a native insect, and like many other insect pests, fed formerly on various kinds of weeds. So far as has been determined, these weeds were mostly grass-like plants, especially the grasses which are closely related to nut grass and chufas. The corn bill bug still continues to feed and breed on these grasses throughout its range in this State. Therefore, corn grown in close proximity to such grasses or in fields where such grasses have been allowed to grow, is more apt to be injured by this insect than corn grown in fields that are free from these grasses.

Therefore, anything that can be done to keep down the native food plants of this insect will be important factors in its control. Many of these grasses are swamp-loving forms. Therefore, as the swampy areas on the farm are brought under better and better drainage these plants will be restricted in area and will therefore furnish less food for the corn bill bug. This will lessen the danger of the insect spreading from

its native food plants to corn. In this connection, the farmers in the bill bug sections of the State should pay particular attention to drainage of swampy areas where the native food plants abound, and should also watch, closely, the edges of ditch banks and similar situations to see that such places do not grow up in these grasses which would furnish these pests with an abundance of food and would act as incubators for their increase.

Also it seems hardly necessary to say that, if some other crop would be grown on swamp land for the first year or two after it is cleared, it would have a tendency to reduce the damage done by this insect.

CONCLUSIONS.

The corn bill bug is a very destructive insect enemy of corn in the eastern part of this State.

It not only feeds but breeds in corn.

In order to control the insect, it seems to be necessary to do everything to promote the vigor and general health of the plant. This can be done early so that it will have a good start before the bill bugs come out of winter quarters, by giving the proper fertilization and cultivation; by having the land properly drained, and by adopting a proper system of crop rotation.